AR gene

androgen receptor

Normal Function

The *AR* gene provides instructions for making a protein called an androgen receptor. Androgens are hormones (such as testosterone) that are important for normal male sexual development before birth and during puberty. Androgen receptors allow the body to respond appropriately to these hormones. The receptors are present in many of the body's tissues, where they attach (bind) to androgens. The resulting androgen-receptor complex then binds to DNA and regulates the activity of androgen-responsive genes. By turning the genes on or off as necessary, the androgen receptor helps direct the development of male sexual characteristics. Androgens and androgen receptors also have other important functions in both males and females, such as regulating hair growth and sex drive.

In one region of the *AR* gene, a DNA segment known as CAG is repeated multiple times. This CAG segment is called a triplet or trinucleotide repeat. In most people, the number of CAG repeats in the *AR* gene ranges from fewer than 10 to about 36.

Health Conditions Related to Genetic Changes

androgen insensitivity syndrome

More than 600 different mutations in the *AR* gene have been identified in people with androgen insensitivity syndrome, a condition that affects sexual development before birth and during puberty. Most of these mutations are changes in single DNA building blocks (base pairs). Other mutations insert or delete multiple base pairs in the gene or affect how the gene is processed into a protein. Some mutations lead to an abnormally short version of the androgen receptor protein, while others result in the production of an abnormal receptor that cannot bind to androgens or to DNA. As a result, cells that are sensitive to androgens become less responsive to these hormones or unable to use these hormones at all. People with this condition are genetically male, with one X chromosome and one Y chromosome in each cell. Because their bodies are unable to respond to androgens, they may have mostly female sex characteristics or signs of both male and female sexual development.

Mutations that completely eliminate the function of the androgen receptor cause complete androgen insensitivity syndrome. Genetic changes that significantly reduce but do not eliminate the receptor's activity cause partial androgen insensitivity syndrome. Mild androgen insensitivity syndrome results from changes that only slightly reduce the activity of the receptor.

androgenetic alopecia

Changes in the *AR* gene are associated with an increased risk of androgenetic alopecia, a form of hair loss also known as male-pattern baldness in men and female-pattern baldness in women. The variations result from small changes in the number or types of DNA building blocks (base pairs) that make up the *AR* gene. These genetic changes appear to be most frequent in men with hair loss that begins at an early age. Researchers believe that *AR* gene variations may increase the activity of androgen receptors in the scalp. Although androgenetic alopecia is related to the effects of androgens on hair growth, it remains unclear how changes in the *AR* gene increase the risk of hair loss in men and women with this condition.

prostate cancer

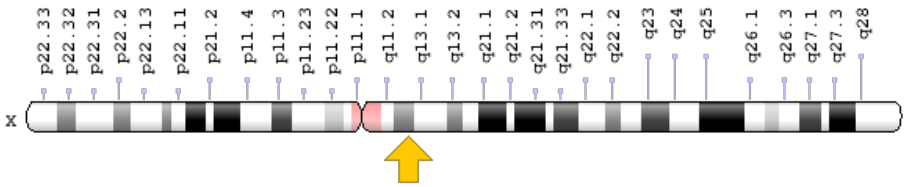
spinal and bulbar muscular atrophy

Spinal and bulbar muscular atrophy, a disorder of specialized nerve cells that control muscle movement (motor neurons), results from an expansion of the CAG trinucleotide repeat in the *AR* gene. In people with this disorder, CAG is abnormally repeated from 38 to more than 60 times. Although the extended CAG region changes the structure of the androgen receptor, it is unclear how the altered protein damages nerve cells. Researchers believe that a fragment of the androgen receptor protein containing the CAG repeats accumulates within these cells and interferes with normal cell functions. This buildup leads to the gradual loss of motor neurons, which results in muscle weakness and wasting (atrophy).

Chromosomal Location

Cytogenetic Location: Xq12, which is the long (q) arm of the X chromosome at position 12

Molecular Location: base pairs 67,544,032 to 67,730,619 on the X chromosome (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- AIS
- ANDR_HUMAN
- androgen receptor (dihydrotestosterone receptor; testicular feminization; spinal and bulbar muscular atrophy; Kennedy disease)
- DHTR
- HUMARA
- KD
- NR3C4
- SBMA
- SMAX1
- TFM

Additional Information & Resources

Educational Resources

- Endotext (2000): Androgen Physiology: Receptor and Metabolic Disorders
  https://www.ncbi.nlm.nih.gov/books/NBK279028/

GeneReviews

- Androgen Insensitivity Syndrome
  https://www.ncbi.nlm.nih.gov/books/NBK1429
- Spinal and Bulbar Muscular Atrophy
  https://www.ncbi.nlm.nih.gov/books/NBK1333

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28AR%5BTI%5D%29+OR+%28androgen+receptor%5BTI%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+360+days%22%5Bdp%5D

OMIM

- ANDROGEN RECEPTOR
  http://omim.org/entry/313700

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/ARID685chXq12.html
- Cancer Genetics Web
  http://www.cancerindex.org/geneweb/AR.htm
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=AR%5Bgene%5D
- HGNC Gene Family: Nuclear hormone receptors
  http://www.genenames.org/cgi-bin/genefamilies/set/71
- HGNC Gene Symbol Report
  http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=644
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/367
- The Androgen Receptor Mutations Database World Wide Web Server
  http://androgendb.mcgill.ca/
- UniProt
  http://www.uniprot.org/uniprot/P10275

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